



JÖNKÖPING UNIVERSITY

*School of Education and  
Communication*

# **How the internet emissions are flying under the radar**

A comparative framing analysis on media coverage

CO2 emissions of the ICT sector vs CO2 emissions of the aviation sector

Juul Kleukers

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Supervisor: Paola Sartoretto  
Examiner: Ernesto Abalo  
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## ABSTRACT

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Writer: Juul Kleukers

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This research provides insights in the media coverage of the CO2 emissions of the ICT sector in comparison to the media coverage of the CO2 emissions of the aviation sector. This adds recognition on the environmental impact of the ICT sector, in the field of communication and media, where this issue is lacking attention. It answers the research questions: RQ 1: What news frames can be identified and how do they differ within media coverage on ICT emissions compared to aviation emissions? RQ 2: How can nationalism and individualism be identified in the news? RQ 3: How is the positive and negative perspective used to argue for the carbon impact of the two topics? Through a qualitative framing analysis this thesis identifies five issue-specific frames. Tech-positive frame, renewable innovation frame, national responsibility frame, corporate responsibility frame, individual responsibility frame. The analysis shows the high presence of techno-centrism in the media and the positive perspective on solutions for the CO2 emissions in the ICT and aviation sector.

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Keywords: Framing analysis, CO2 emissions, ICT, Aviation, Sustainable  
Communication, Techno centrism, Mass media

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# 1 INTRODUCTION

## *1.1 Sustainable development and technology*

Information Communication Technology (ICT) is a useful tool for sustainable development. Sustainable development is defined as the development that “[..] meets the needs of the present without compromising the ability of future generations to meet their own needs“ (Brundtland, 1987, para 27). Reaching, communicating, and co-operating for sustainable development is getting faster and more inclusive, because of the internet and technical solutions. Technological optimists believe the implementation of technology is even the primary solution for environmental problems (Alexander & Rutherford, 2019) and this mindset has settled into the western culture, both in the scientific community and the mass media (Ehrlich & Ehrlich, 2011). Techno centrism sees technology as the center of its society, where technology can affect, control and protect the environment (LinusWealth, 2019). It focuses on technology as the solution to fixing damage that has been done to the environment. A recent study of Salman (2019) of techno centrism in Finland and Bhutan showed that technological solutions get highlighted, and critiques of these solutions are often disregarded. “We tend to fix any technological problem with another new technology” (Salman, 2019 p16). This also shows in the UN development goals, where technological innovation is used to achieve many of the goals (United Nations, n.d.). In 2003 and 2005, the United Nations organized the World Summit of Information Society (WSIS). The summit addressed the opportunities and issues raised by the ICT sector to support the achievement of the SDGs. Their goal was to increase internet accessibility worldwide to decrease the welfare gap between countries. This shows that the UN wants to use ICT to tackle climate change. It is also a goal in itself, goal 9, to enable affordable technical capabilities in all countries. This implies that the ICT sector will be growing even more, which is why it is so important that the ecological impact is considered and dealt with. The ICT sector is important for sustainable development, but brings along large amounts of electrical waste, carbon emissions, loss of physical space, and is the sector with the fastest-growing energy consumption (Tjoa & Tjoa, 2016). The ICT sector is even shown to contribute the same amount of carbon emissions as the aviation sector (Parliamentary Office of Science and Technology, 2008). The UN goal 12 ‘responsible consumption and production’ already addresses the problem of the exponential growth of digital waste (United Nations, n.d.) and scientific research has been done about minimizing the ecological footprint of the internet. Although the UN goals briefly covers the problem and there is research to use, for the general

public it is not widely known that the internet can be very environmentally unfriendly. This shows an example of alienation and must be recognized in the field of media and communication studies.

### *1.2 Information and Communication Technology*

The world is digitalizing, and with technological innovation, everything seems possible. From online meetings with people all around the world to fridges that talk to you, it is all within reach. The Information and Communication Technology sector is growing and expanding, and a (sustainable) society is relying on these developments. The ICT sector has no official definition, but it is widely accepted that the sector includes all communication technologies and devices, e.g. internet and any other media application that shows information and allows interaction in a digital form (Pratt, 2019).

### *1.3 Comparing carbon emissions*

As mentioned in paragraph 1.1, the ICT sector emits the same amount of CO<sub>2</sub> as the aviation industry. The aviation industry accounts for an estimated 2,5% of the global carbon footprint (Ritchie, 2020), and the public recognizes this the problem (World Wild Life, n.d.). The industry even has its own specific name for the shame that comes with using the sector, called ‘flight shame’ (Asquith, 2020). ‘Flight shame’ explains the feeling of uneasiness and concern about the environmental impact of flying and was first introduced in Sweden (Gössling et al., 2020). Meanwhile, one of the newest studies about the ICT sector showed that ICT also contributes between 2,1-3,9% of the global carbon footprint (Freitag et al., 2020). Contrary to the aviation industry, the ICT sector seems to be able to keep the emissions under the radar, which means that they do not get the recognition of being a polluting industry. It must be noted that opposing voices argue that it is difficult to compare aviation with ICT emissions. They state that the comparison is like comparing apples with oranges, as the calculations are more complex than simply comparing the carbon footprint of the data centers and the burning fuel of the airplanes, and the proposed percentages are only a highly researched estimation (Ericsson, 2020). Nevertheless, in this thesis the focus is not on the specific numbers of the CO<sub>2</sub> emissions, but on the huge difference between the publics’ attention on the emissions. This study will therefore be centered around the differences in media coverage between the two sectors. This will be done with a focus on individualism vs nationalism and positive vs negative perspectives as these are previously researched topics that influence the media framing.

## **2. AIM AND RESEARCH QUESTIONS**

This research aims to contribute knowledge in the research field of **Environmental Communication**, with a qualitative framing analysis on media coverage of ICT carbon emissions and aviation carbon emissions. This research will add research and recognition about the environmental impact of the ICT sector, which is lacking attention in the communication and media research field at the moment, by answering three research questions:

**RQ 1:** What news frames can be identified and how do they differ within media coverage on ICT emissions compared to aviation emissions?

**RQ 2:** How can nationalism and individualism be identified in the news?

**RQ 3:** How is the positive and negative perspective used to argue for the carbon impact of the two topics?

These questions, and therefore this research, will assist in understanding the relationship between the emissions of the ICT sector and the media better and comparing these findings with the emissions of the aviation sector.

## **3. LITERATURE REVIEW**

### *3.1 Previous literature*

This literature review contains previous studies on communication in the media concerning ‘climate change’ as a general term and contains previous studies on the environmental impact of the ICT. The two research fields are relevant for this study, although barely combined with each other before. The research gap will therefore integrate the two fields.

### *3.2 Climate change communication in the media*

“The mass media can play an important role in influencing people’s attitudes towards global warming” (Dirikx & Gelders, 2009, p201) which is very important to recognize, as public attitudes play a big role in the implementation of environmental policy. Hence, research in the field of climate change communication in the media is necessary. Dirikx and Gelders (2009) compared the framing of climate change in two European countries, The Netherlands and France in their research ‘Global warming through the same lens’. They state that the mass media is responsible for a large portion of the scientific knowledge of citizens. They also argue the public perception of risks, in this case climate change risks, is highly influenced by the

media and that the media can decide what the people are thinking about. The agenda-setting theory argues that the media can decide where the attention of the public goes. The amount of media information on a topic and the framing of the information influences where the attention of the public goes. They carried out a content analysis on two quality newspapers in The Netherlands and France where they analyzed the articles every year from 2001 – 2007, during a period of 10-13 days around the climate change conference of the United Nations called Conference of the Party (CoP), and screened articles with the words ‘climate change’, ‘global warming’ or ‘greenhouse effect’ in the title of the introduction. This, to discover similarities and dissimilarities between the countries. They included columns, ‘classic’ news articles, commentaries and interviews. They used the coding method made by Sementko and Valkenburg, which included a list of 20 questions. The analysis showed that the French and Dutch both mostly featured long climate change articles with background information, which can help with the increase of readers’ belief in, and better understanding of global warming. Both the media in the Netherlands and France uses the responsibility frame and consequences frame more often than the conflict frame. It concludes that the two countries have a similar approach to climate change communication, where they both focus on scientific certainty in the news articles.

Whereas the research on Dirikx and Gelders focuses on comparing media coverage in different countries, Berglez, Höijer, and Olausson (2009) analyzed the media coverage of climate change in Sweden. In their research ‘Individualization and nationalization of the climate issue’ they compared nationalization and individualizing. Sweden is a good example of how the media helped gain interest in the climate issue by Swedish population, as 94 percent of the Swedish population knows about the greenhouse effect, 82 percent believes that Swedes will be affected personally by climate change, and 69 percent see the extreme importance of taking action. This research focused on the nationalization and individualization of climate change in leading Swedish news media. A qualitative research was executed by analyzing two series about climate change in the Swedish media, based on the theory of social representations. Next to this analysis, they also interviewed 14 environmental journalists in Sweden about nationalization and individualization in the media. They found that both ideological horizons show their strength, they also come with problems. With an individualization focus, the research shows that the Swedish media puts hope and blame on the individual and the interviewed journalists emphasize that the individualization of the problem can be very effective, but individuals will not stop climate change alone. The journalists struggle with their

ideals of not overly presenting the individualization of climate change while being ‘forced’ by the ‘media logic’ of today’s society to focus on the personal aspects instead of the structural aspects. Meanwhile, news with a nationalization focus shows border limitations, even though it is actually a global problem in need of global journalism. The research showed concern about the glorification of Sweden’s role in the world. The journalists do stress the importance of national attention for commercial reasons, it is natural that Swedish consumers will prioritize news about themselves, over global news.

Later researches’ show the changing media scene and it is important to acknowledge the rise of new digital media. With the growth of the internet and social media, the media landscape is quickly changing. Painter et al. (2018) looked at the differences between ‘digital-born’ media and legacy media with a case study of the COP 21 summit in Paris. They refer to media that started online and is not an extension of existing physical newspaper as ‘Digital-born’ media and legacy media is the classic newspaper. Digital-born media differs from legacy media in several ways, like funding models, investors, editorial priorities, and that they rely heavily on social media for the distribution of the content. Digital-born media also seems to give more priority to environmental topics. With the growth of the internet and social media, a big change in public information consumption emerged and on that account, Painter et al. (2018) investigated the differences between the digital-born media and the legacy media with a focus on the volume of the coverage and the selection of themes. This resulted in the discovery of several differences between legacy players and new digital-born players and mostly between the new players themselves. The digital-born players can be distinguished into two different types. The ones that try to compete with the legacy media and the ones that take a different approach with their content, with targeting a younger target group. They concluded that it is not possible to separate digital-born media and legacy media in only these two groups as they seem to differ widely within the group.

### *3.3 Environmental impact of the ICT sector*

While the previous studies focused on media coverage of climate change as a whole, this thesis paper will analyze a more specific topic within climate change. The media coverage of the environmental impact of the ICT. The environmental impact of the ICT sector gets quite some attention in the field of technology research, with early research (The Climate Group, 2008; Williams, 2004) and more recent research (Andrae & Edler, 2015; Van Heddeghem et al., 2014). They focus on current ICT emissions and the expected contribution of the sector to the



global carbon footprint. Lotfi Belkhir and Ahmed Elmeligi are one of the researchers that most recently studied the current and future full contribution of the ICT sector to the global carbon footprint with a focus on smart phones and tablets (Belkhir & Elmeligi, 2018). They predicted the impact of the ICT sector on global emissions to be 14% by 2040 with a rapid rise in smartphones. Next to these researchers, Greenpeace is one of the only environmental NGO's that pay attention to the carbon problem of the ICT and added to the research field with an analysis on big internet companies and their contribution to the carbon footprint (Greenpeace, 2017). They found that Apple and Facebook are the most transparent about their data center energy footprint, but many companies in the sector are silent about their energy use. The silence and non-transparency about energy use is a problem as the publication of energy use is important to show that a company takes the issue seriously and to create available data that can be used for further research and for gaining media attention.

Contrary to this large amount of research on the emissions of the technological side, in the field of media studies, the environmental impact of the ICT sector seems to be neglected and failed to be acknowledged. Richard Maxwell and Toby Miller (Maxwell & Miller, 2012) broke this barrier and wrote 'Greening the media'. They recognize that for understanding media, it is required to study media in all ways, including the polluting technological side that the rising sector brings. The two writers look into how the media technologies contributed to the climate crisis. Where the problem of over-consumerism has been exposed in fashion and other physical products, it can be argued that a bigger problem lays in the digital world. Maxwell & Miller (2012) give several examples of movies that are supposed to be good and adding value to an environmental cause, but Maxwell & Miller show that the production of these movies is actually harming the environment more and shows underlying power structures. The main problem that Maxwell & Miller found in their research was the lack of consumer awareness of the environmental impact of digital products. They highlight the conflict between large institutional change and the individual role. It is questioned if individuals can play a significant role in sustaining digital media or if the change should just come from the top-up. The research ends with the statement that the next designers of media technologies have to take into account the problems raised by Maxwell and Miller.

### *3.4 Research gap*

In conclusion of previous research, exploitation behind digital media has to be recognized but the research field of media and communication is lacking research on the environmental impact

of the ICT sector. To understand the relation between the emissions of the ICT sector and the media better, this thesis paper will execute a comparative framing analysis. Analyzing the media coverage of the ICT emissions and comparing this to media coverage on aviation emissions to give an understanding in the unfair publics' attention. The comparison between the emissions of the ICT sector and the aviation sector is chosen as they both are, arguably, the same but the publics' attention is unevenly distributed between the two.

The analysis examine the amount of media coverage on the topics and the framing of the given information as Dirikx and Gelders (2009) argue that these two factors determine where the attention of the public goes. To narrow down the analysis, the research will be based on the topics individualism vs nationalism and positive vs negative media coverage, which are mentioned in the previously referred articles.

## **4. THEORETICAL FRAMEWORK**

### *4.1 Theories*

For this research paper, several theories and concepts are used to create a study case. This includes sustainable communication, specifically within the mass media, news framing theory, the terms nationalism, individualism, and techno centrism. The theories are explained to give a thorough understanding of the used material.

### *4.2 News framing theory*

Framing theory has various roots in e.g. psychology and sociology, and the theory is now widely used in the field of media and communications. According to Tewksbury & Scheufele (2019), framing theory suggests that the presentation of the news influences the way the public interprets and processes this information. Entman (1993) defined frames as a tool for the public to decide what the problems are and helps with creating opinions and judgments. Therefore, journalists can influence public opinion by choosing the used language, highlighting certain aspects of the news, and filter the information that is important in their opinion (Gitlin, 1980). Nisbet and Mooney (2007) see framing as a way to get information structured and understandable, where it selects certain aspects of a story and excludes other parts. All these ideas from different researchers are originated from sociologist Ervin Goffman's definition of framing theory. He described frames as ideas of interpretation that helped people perceive and identify certain events and information (Goffman & Berger, 1986). Later, Entman translated

this theory to media research. Framing theory consists of two different frame typologies, generic news frames and issue-specific frames. While issue-specific frames are frames that are detailed and only relevant for certain topics, generic frames are applicable in a broader sense (Vreese, 2002). For instance, Semetko & Valkenburg (2000) identified five generic frames that are common within news framing to attract the audience's attention. Conflict, Human interest, Consequence, Morality, and Responsibility. The conflict frame attracts the public's attention by emphasizing conflict between groups or individuals. The Human interest frame personalizes the story by bringing a human face or emotion to the issue. The consequence frame focuses on the economic impact of the issue. The morality frame is often an indirect frame that centers around moral prescriptions or religious tenets. Last, the study explains the responsibility frame as the frame that "[...] presents an issue or problem in such a way as to attribute responsibility for its cause or solution to either the government or to an individual or group" (Semetko & Valkenburg, 2000, p.96). They differentiate episodic and thematic media coverage and while episodic explains an issue on an individual level and urges individual responsibility, thematic shows the issue in a bigger historical social context and gives responsibility to bigger systems or governments. Even though this study is already twenty years old, these five frames are still commonly used within newer framing research (Adiprasetyo & Larasati, 2021; van Drunen et al., 2021; Valencia & Moscato, 2020).

#### *4.3 Sustainable Communication in the Mass Media*

As mentioned in the introduction, mass media has a big effect on the societies view of the news. Mass media is explained as the communication of information to a large number of people through mediums, which are channels of communication (Livesey, 2011). McQuail (1994) argues that mass media can have a big influence on society through redirecting public attention to certain topics, structuring reality, conferring status, quick informing, persuasion, and influencing the public's behavior. Even though mass media can be seen as outdated as it talks about the traditional media, McQuail argues that mass media evolves over time and is not disappearing. New terms like 'mass self-communication' develop where the readers can choose which content they want to consume (Mcquail & Deuze, 2020). The mass media and the way of communicating through mass media will be analyzed in this study, by focusing on several news websites. The focus will be the communication of sustainable topics, hence a particular way of journalism has to be explained. A rising field of interest within sustainable communication and the mass media is sustainable journalism. Sustainable journalism is defined as "[...] journalism that meets the information needs of the present without compromising the

ability of future generations to meet their own journalistic information needs” (Berglez et al., 2017, xxii). Lewis (2017) explains that sustainable journalism is reporting about sustainability, but also concerns reporting that is useful instead of transitory. Adjin-Tettey (2021) adds sustainable journalism intertwines environmental journalism, social journalism, and economic journalism and makes sure that they are connected within the storytelling. Environmental journalism includes reporting on e.g. climate change and nature loss. Social journalism focuses on e.g. human rights and equality and economic journalism reports on the financial sector. These three sectors all influence each other and therefore it is important to connect them during the reporting. This research will focus on the coverage of sustainable topics, the environmental impact of two sectors, which is why it is important to take into account the definition of sustainable journalism.

A rapidly growing approach to sustainable journalism is constructive journalism, which is the reporting of solution-based news, instead of conflict and negative stories. This new approach of news coverage is most popular by young people and is argued to be a more accurate reflection of reality, which can fight the current rise in news avoidance. News avoidance is the currently rising phenomenon of the public avoiding hearing and reading about the news. (Skovsgaard & Andersen, 2019). Constructive journalism engages the public again with focusing on solutions, but also plays with positive emotion and McIntyre (2015) found that emotion is the key to gaining public engagement and not the information of the solution in specific. This is also how constructive journalism can be distinguished from positive journalism as this type of journalism is considerably less serious and includes more stories of ‘heroes’ and individual events as solutions. While constructive journalism explores one or more solutions in-depth (Green, n.d.) and has individual motivation as a primary goal, positive journalism does not take into account the prime journalism goals and consequently is less effective.

This all is researched under the research field of media and mass communication which concerns “[..] what people and social institutions actually do with media – and is generally committed to answering societal communication problems with research of real-world relevance.” (Mcquail & Deuze, 2020, p5) This study will also add research to the field of media and mass communication.

#### *4.4 Individualism and Nationalism*

Individualism and nationalism are mentioned in chapter 3 by Berglez, Höijer, and Olausson (2009) as they compared the two viewpoints. Individualism is referred to as, giving individuals

the responsibility of making choices and mainly focuses on western society as an individualized society. Therefore, this research paper will identify individualism as the representation of the coverage where the individualistic society is highlighted and therefore shows the power that individuals can have. The focus on individualism in the media can provide more attention to the desired topic and adds a higher chance of the reader processing the information (Rickard et al., 2014). Contrary, nationalism puts the nation-state in the foreground. This can include national pride, power, or competition with other countries. In the news, nationalism can be identified as “news stories that emphasize *our* country’s positive contributions to the world” (Berglez et al., 2009, p.214). In this research paper, nationalism will represent the coverage of news where a nation as a single unit carries its own responsibility.

## **5. METHOD**

### *5.1 Choice of method*

For this research, a qualitative framing analysis will be used as the method. As discussed in chapter 4, news frames determine where the attention of the public goes. Thus, a framing analysis can be helpful to understand how these issues are covered by the media and how this relates to the unbalanced distribution of the publics’ attention towards the aviation and ICT industry. Qualitative framing analysis involves deep familiarization of the content and looks at the material with a holistic view to identify frames and will be done in a qualitative matter, where a small sample is researched in detail. Qualitative research helps to understand and get a deeper insight into the subject by interpretation. Framing researchers have argued that interpretation and attention to language have to be prioritized in news framing - and therefore qualitative research is needed (D’Angelo et al., 2019).

### *5.2 Roadmap*

To conduct the frame analysis structurally, a 4-step preliminary process was designed. This step-by-step process is based on the research of Linström & Marais (2012) and adjusted based on the situation of this research.

1) Determine topic, medium, timeframe and frame typology	2) Determine sample selection	3) Familiarization of content	4) Indexing and frame defining
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### 5.2.1 *Determine topic, medium, timeframe and frame typology*

**Topic** The two news topics that this research will focus on is ‘CO2 emissions of the ICT sector’ and ‘CO2 emissions of the aviation sector’. These two topics are chosen as they are both argued to contribute the same amount of carbon emissions to the global carbon footprint, but the publics’ attention on the two topics is not distributed evenly. The framing analysis will determine how the two topics are framed in the current media.

**Medium** A medium is the channel of communication (Livesey, 2011), and for this analysis two news websites are the chosen media. In the literature review in chapter 3, legacy media is explained as the traditional media, like the classic newspaper, and digital-born media is media that originated from the internet (Painter et al., 2018). Digital-born media is changing the media environment, hence it is important to acknowledge these types of media. This study will include legacy media and digital-born media in the analysis, as this will give a more realistic representation of the media coverage, according to Painter (2018). CNN is a ‘legacy’ news company, originated from the USA and this website has been chosen for this analysis, because it is one of the biggest global news websites (Pew Research Center & ComScore, 2015) with an international platform, where they also cover environmental topics. They have an accessible open database with their news articles. Their audience is extensive, as they had been the news platform with the most unique visitors in 2019 with a large number of millennial visitors (CNN, 2020). Next to CNN, Greenbiz.com will also be taking into account, as the media scene is changing and new ‘digital-born’ media cannot go unrecognized. Digital-born media can differ massively from legacy media, and to prevent research that is too broad and not specified enough, Greenbiz has been chosen as it is a digital-born media but does compete with legacy media in the way they cover media. This creates a limited and more specified media environment in which this research will take place. Greenbiz especially focuses on sustainability and social change. While based in the USA, the company has a global approach. Next to the news platform, they also provide events, networks, and research to define and accelerate the business of sustainability. “Our goal is to ensure that GreenBiz Group — and the industry — reflects the world that we live in, and the world we want to see.” (GreenBiz, n.d.).

**Time-frame** The number of articles that include ‘CO2 emissions’ on the websites in the year 2019 will be counted. The year 2019 is chosen because it is the most recent year, that was not effected by Covid-19. The pandemic could lead to atypical data.

**Frame typology** While acknowledging the previously defined generic frames, described in chapter 4, an inductive approach is chosen, where frames emerge from the studied material during the analysis. This is different from a deductive approach, where the analysis is carried out with premade frames in mind (Vreese, 2005). The inductive approach is chosen as the comparison between the two sectors is new research with little previous framing research on the specific topics, where no earlier frames have been uncovered. This makes a deductive approach unrellevant. Instead of predefined frames, the research will be constructed by focussing on two themes based on previous research, see chapter 3. These themes are nationalism vs individualism and positive vs negative attention and will be the basis of issue-specific-frames.

### 5.2.2 Determine sample selection

In total eight articles were chosen for the analysis. These articles were chosen out of a total of 1.172 articles. Within these articles, 72 articles on aviation were found and ten articles on ICT, see figure 1. Articles that talked about aviation or ICT and also included CO2 emissions, but did not have the CO2 emissions as their main topic were not included in this selection. For example, an article about a new plane that is launching and the CO2 emissions of that plane are briefly mentioned can show up in the selection of CO2 emissions, but are not counted as an article on aviation emissions.

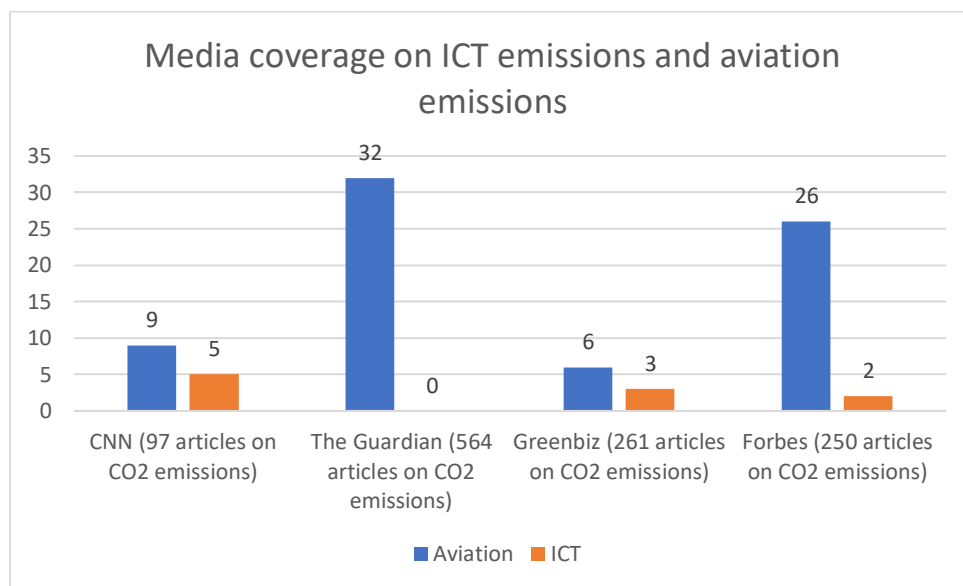


Figure 1 Media coverage on ICT emissions and aviation emissions in 2019

The Guardian showed the biggest difference in aviation and ICT emissions, where 564 articles were scanned in the section 'Greenhouse Gas Emissions'. For the Guardian selection, the section 'Greenhouse Gas Emissions' was chosen as it was already a premade section and also includes CO<sub>2</sub> emissions. 32 articles were found on aviation emissions, but zero articles had ICT CO<sub>2</sub> emissions as the main focus. To rule out the possibility that the ICT emissions are under another section than 'greenhouse gas emissions', all articles in the Guardian archive were searched for the terms 'data center', 'low carbon IT' and 'cloud computing' as these are all related section in the Guardian archive. But the last article on 'low carbon IT' was in 2012. The section 'Data center' has its last article in 2015 and the section 'cloud computing' had its last article in 2014.

The other news platforms showed more articles on ICT emissions, but the content review definitely shows that the news platforms pay more attention to the aviation sector when it comes to CO<sub>2</sub> emissions. It is noteworthy to mention that GreenBiz.com shows a lot more transportation articles but seems to keep the articles broad and include car travel with air travel. These broader travel articles were not included in the content review. Next to that, the news platforms show a lot of technological solutions that are helping sustainable development but do not mention the CO<sub>2</sub> emissions that come along with this. This content review was needed for sorting the articles and already gave a clear insight into the difference in the media coverage of the two sectors.

The remaining articles, 72 articles on aviation and ten articles on ICT, were screened again for the framing analysis and eight articles were chosen (see table 1). Four articles on ICT CO<sub>2</sub> emissions and four articles on Aviation CO<sub>2</sub> emissions. These articles were chosen for several reasons. Firstly, only four ICT articles were left after filtering out interviews and opinion pieces. This also included a closer look at the articles and some articles were taken out as they were not relevant enough, which means that the CO<sub>2</sub> emissions of the ICT sector were not the main topic of the article after all. To match the four articles on ICT emissions, the aviation articles were chosen based on size and relevance, making sure that there are, again, no opinion and interview pieces included and that the amount of text comparable is with the articles of ICT. Secondly, only CNN and Greenbiz had relevant ICT articles and therefore the analysis will focus on these two news websites. This means that four articles are from a digital-born source and four articles are from a legacy source.

The analysis will be done by summarizing the articles, while also looking at the structure of the text and the context. Who has written the text and where they are from, the order of the content, the additional visuals, and the sources.



CNN	Reference name	Date	Name	Word count	Link
ICT	ICT Article 1 (IC1)	16/04/2019	Microsoft hikes its internal carbon tax in a new sustainability drive	466	(Kottasová, 2019)
ICT	ICT Article 2 (IC2)	14/06/2019	Bitcoin leaves a carbon footprint as large as Las Vegas, study finds	233	(Lou, 2019)
ICT	ICT Article 3 (IC3)	10/09/2019	China's data centers emit as much carbon as 21 million cars	654	(Zaugg, 2019)
Aviation	Aviation article 1 (AC1)	19/11/2019	EasyJet flights are now carbon neutral	474	(Iyengar, 2019)
Aviation	Aviation article 2 (AC1)	17/12/2019	Thousands of people have stopped flying because of climate change	846	(Gerretsen, 2019)

GreenBiz	Reference name	Date	Name	Word count	Source
Aviation	Aviation Article 3 (AG3)	20/11/2019	Shell to support Europe's first sustainable aviation fuel plant	346	(Early, 2019)
Aviation	Aviation Article 4 (AG4)	30/04/2019	Get set for take-off in electric aircraft, the next transport disruption	857	(Whitehead & Kane, 2019)
ICT	ICT Article 4 (IG4)	09/07/2019	Salesforce, Microsoft, Apple push Virginia utility to use more renewables, less gas	1283	(Sweet, 2019)

Table 1: Chosen articles

The articles have been given a reference name to make it easier to mention the articles, for example article I1C. The first letter indicates if the article is about ICT (I) or aviation (A) and the second letter indicates if the articles was published on CNN (C) or Greenbiz (G).

### 5.2.3 Familiarization of content

The framing analysis is based on familiarizing with the content. This implies that the eight articles were thoroughly read many times, summarized and categorized based on several topics. The topics that this analysis focused on was individualism vs nationalism and positive vs negative perspective. This gives this study a specific focus, and does not represent other frames present in the articles but fully prioritizes the given topics. An overview of the articles with a short summary can be found in table 2.

Reference name	Author	Place	Summary	Visual
IC1	Ivana Kottasová	London	Microsoft almost doubled their internal carbon fee for its business units that was introduced in 2012. The fee is based on energy from data centers, offices, factories and employees business air travel from their business units. Microsoft's commitment is crucial and upped their climate change targets by powering 70% of their data centers with renewable energy by 2023. Microsoft's cloud business is growing and want to reinvent Microsoft as a cloud computing company. The tech industry is growing and therefore also the carbon footprint, mostly driven by the growing data centers. Microsoft is working on cutting emissions, but recognizes that they have to do more. They want to do this by using technology, like AI. Microsoft argues that AI can help reduce a lot of emissions. Microsoft earned praise for its efforts.	Video title: "microsoft bets on AI to fix climate change"
IC2	Michelle Lou	Global	A new study shows that Bitcoin leaves a big carbon footprint, comparable to the environmental impact of Las Vegas and Sri Lanka. The blockchain technology that bitcoin depends on uses a lot of electricity. Even though there are bigger factors contributing to climate change, it is worth talking about and thinking about future regulations. A solution could be to link mining farms to additional renewable generating capacity.	Photo of physical bitcoin
IC3	Julie Zaugg (freelance journalist in Hongkong)	Hong Kong	China has a lot of data centers and even though the use of renewable energy is rising, most of the data centers still use coal because the renewable energy facilities are located too far away. As the demand of data centers in China is growing, with new data centers from e.g., US company Apple, something has to change to prevent a huge increase in CO2 emissions. This can be done with their own energy capacity, buying clean energy or buying green certificates to offset emissions. The Chinese government took action in 2015 by launching a green data center pilot. The US technology companies that are based in China are also supporting the change in energy as they want their data centers to run on renewable energy. In the US Apple's data centers are already powered by renewable energy and Microsoft and Amazon are also working on 100% renewable energy.	Photo caption: "Aerial view of Tencent's biggest data center under construction in a mountainous area of Guizhou province, on March 13, 2018."

IG4	Cassandra Sweet (writer and consultant) from the USA	USA	<p>Technology companies are asking Virginia and Dominion Energy, who is building the power plants, to produce renewable energy for their data centers in Virginia to help them with their sustainability goals. While Virginia has around 70% of the world's internet traffic flowing through their data centers, it lags behind on renewable energy development. Dominion states that they share the goals of their customers, but costs are the main problem. In contrary, research's show that solar-plus-storage projects can be cheaper than gas fired projects. Environmental and sustainability groups are also putting pressure on Virginia to change to renewable energy, as for example, California already produces half of their power from renewables. The situation in Virginia could improve by the Virginia lawmakers and officials that are pushing clean energy and The Virginia State Air Pollution Control Board introduced a new regulation to reduce CO2 emissions and fossil fuels power plants.</p>	Photo caption: "A Dominion Energy solar installation in Virginia."
AC1	Rishi Iyengar, india editor	New Delhi	<p>EasyJet announced to be the first major airline to operate net zero carbon as it will compensate the emitted CO2 by investing in programs that remove CO2 from the air. They recognize that offsetting is an interim measure, but they want to reduce their carbon footprint on the short term as well as working on long-term solutions. EasyJet states that it already reduced carbon emissions by flying more fuel-efficient aircrafts and loading planes to the maximum. They collaborate for solutions like hybrid and electric aircrafts.</p> <p>Airlines are under pressure to take urgent action, because of activists like Greta Thunberg, that promoted the hashtag 'flight shame' as they argue that the global emissions of the aviation industry is big and rising. European carries seem to take action first as more European airlines are offsetting and taking action.</p>	NOT APPLICABLE
AC2	Isabelle Gerretsen (Dutch-English working in UK)	Global	<p>More and more people are choosing alternative options over flying as 'flying shame' gains attention. The aviation industry itself is doing too little to reduce their carbon footprint, according to Grantham Research Institute on Climate change. The footprint of air passengers depends on how far they fly, how full the plane is, but also what class the fly in. The footprint of train passengers depends on e.g. how the train is powered. And while air travel can be made more sustainable with sustainable fuels and new technologies, the emissions of the train can be reduced more easily.</p>	Several different planes & pictures of Roger Tyers travels
AG3	Catherine Early london based journalist	Europe/ Netherlands	<p>Shell will support Europe's first sustainable aviation fuel production plant with technical and commercial expertise. SkyNRG, founded by KLM, will run the plant. The plant is going to produce fuel from waste and will run on hydrogen. This will reduce the carbon emissions by 85% in comparison to conventional jet fuels. In return for Shells support, shell aviation will secure the option to buy the fuel. Anna Mascolo, the vice president of Shell aviation states that the aviation players need to collaborate, with support of technical innovation and a multiple set of solution to create a faster transition into a net zero emissions world. This is one example of a project that is under development. For example, Shell has another project in Lincolnshire.</p>	Photo of plane
AG4	Jake Whitehead & Michael Kane researchers from Australia	Australia	<p>Electric aviation is an upcoming disruption that's been ignored by Australian transport infrastructure. As Australia relies on air travel, the sector keeps growing and as infrastructure projects are planned years ahead, it is important to start with electric aviation to capitalize on the environmental and economic benefits. The electric aircraft exist in the form of short-haul planes and Vertical Take-Off and Landing (VTOL) vehicles, like drones. Development is expected in the upcoming years, this could mean small, commercial, electric airplanes flying in Australia. These aircrafts could reduce environmental and financial costs and create new export opportunities. The electric aircrafts could distribute more easily to smaller airports and also be effective for bigger airports by overcoming low-noise and zero-emissions constrains. Air freight could also be improved with electric aircrafts as it would increase efficiency in the transportation to transport hubs or even direct consumers through VTOL vehicles. Australia should prepare for the disruption of electric aviation as it's already falling being with other disruptive technical changes.</p>	Photo 1: Airplane on charge Photo 2: Australia map with domestic flights Photo 3: train and airplane

Table 2. familiarization of content

#### 5.2.4 Indexing

While familiarizing with the content, the viewpoints, perspectives and conversations about the topics were written down of each article to find similarities and differences between the articles. Based on this information, overarching frames were identified. The frames were distinguished in two groups. Group one, the responsibility frames, which includes the corporate responsibility frame, individual responsibility frame, and the national responsibility frame. Group two, the solution-orientated frames, which includes the tech-positive frame and renewable innovation frame. These frames were then coded into first and secondary frames, based on the structure of the article. If the article started with the solution and the solution was a reoccurring topic in the article, the solution-oriented frame was given a F1. If the article was mainly focused on the responsibility of a certain group, the responsibility frame was given an F1. If the frame was found in an article, but only mentioned once, or talked about at the end of the article, the code F2 was given. If the frame did not occur in the article, NA was given (Di Gregorio et al., 2011) (see table 2). During the coding of the frames, the main frame and secondary frames of the eight articles were identified.

Article name	Corporate responsibility frame	Individual responsibility frame	National Responsibility frame	Tech positive	Renewable innovation
IC1	F1	NA	NA	F2	F2
IC2	F1	NA	NA	NA	F2
IC3	NA	NA	F1	NA	F2
IG4	F1	NA	F1	NA	F1
AC1	F1	F2	NA	F2	F2
AC2	F2	F1	NA	F2	F2
AG3	F1	NA	F2	F2	F2
AG4	NA	NA	F2	F2	F1

Table 2. Coding of frames in articles

F1: Main frame

F2: Secondary frames

NA: Not Applicable

### *5.3 Research quality and limitations*

This research comes with several limitations, and measures to preserve the quality of this study has to be taken. Firstly, the method is time-consuming and the given time for this study was limited. Therefore, the choice of focusing on a small number of articles and restricting to a very specific focus was chosen, the focus was nationalism/individualism and positive/negative perspective. This means that the analyses cannot represent a complete picture of the framing in the media, but only gives a starting point for further research. Furthermore, framing analysis can be criticized as a subjective process. To ensure reliability, the research uses previous framing analysis and their frames to compare and connect to. This way, the frames are inductive, but are comparable and ensured of quality based on other research. The previous research used, was about the framing in media of climate change in general, as there is not yet specific research on framing of ICT and aviation emissions in media. Additionally, it has to be noted that the choice of news sources was limited, as many news outlets did not have an accessible database of their news articles. In addition to this, the number of articles on CO2 emissions of the ICT sector was limited. There was a small number of articles to choose from as the ICT sector is not often mentioned in combination with their CO2 emissions, therefore it was not possible to filter the articles on basis of e.g. word count. CNN.com and Greenbiz.com are both English-language websites. This was chosen as today's media landscape is very international and crosses national borders. Therefore the international websites are a good representation of the current media landscape. Two other English-language news websites were also supposed to be used for the analysis, The Guardian and Forbes. They were taken into account during determining the sample selection (see paragraph 5.3.1), but not used in the framing analysis as they did not contain enough relevant articles.

## **6. FINDINGS AND DISCUSSION**

### *6.1 Identified frames*

This chapter will present and discuss the identified frames (see table 3 and 4) in relation to earlier theory and research. The analysis has recognized several issue-specific frames. The frames are categorized into two overarching groups, the responsibility frames, and the solution-orientated frames.

### Responsibility frames – Emphasis on the responsibility of a specific group.

Frame	Explanation	Main frame in:	Secondary frame in:
Corporate responsibility	emphasis on the achievements or liability of companies	IC1, IC2, IG4, AC1, AG3	AC2
Individual responsibility	emphasis on the achievements or liability of individuals	AC2	AC1
National responsibility	emphasis on the achievements or liability of a country	IC3, IG4	AG3, AG4

Table 3. Responsibility frames

### Solution-orientated frames – Emphasis on how a problem is or can be solved

Frame	Explanation	Main frame in:	Secondary frame in:
Tech-positive	emphasis on the resolutions shaped by technology	NA	IC1, AC1, AC2, AG3, AG4
Renewable innovation	emphasis on the possibilities of renewable energy	IG4, AG4	IC1, IC2, IC3, AC1, AC2, AG3

Table 4. Solution-orientated frames

## 6.2 Responsibility frames

The responsibility frames focus on the responsibility of a certain group, concerning the issue raised in the article. Responsibility was already a recognized frame described by Semetko & Valkenburg, see chapter 4, but where responsibility is a frame on its own in Semetko & Valkenburgs' research, this analysis established three different responsibility frames. Corporate responsibility, individual responsibility and national responsibility.

### 6.2.1 Individual responsibility frame

Frame	Explanation	Main frame in:	Secondary frame in:
Individual responsibility	emphasis on the achievements or liability of individuals	AC2	AC1

The individual responsibility frame concerns the acknowledgment of the responsibility that the public and citizens have on a specific issue. This frame was not as present as other responsibility frames, as it was only seen in two out of four aviation articles. Article AC2

(Gerretsen, 2019) is the only article where the individual responsibility frame can be identified as the main frame of the article. In this article, the story is built on social actions. The article shows examples of the progress and changes that individuals have made:

AC2 – “According to a survey released in May 2019 by Swedish Railways (SJ), 37% of respondents chose to travel by train instead of plane where possible, compared to 20% at the start of 2018“

AC2 – “Thousands of people worldwide have publicly pledged to stop flying, including teenage activist Greta Thunberg, who has inspired youth climate protests around the world.”

And even tries to inspire individuals to help make a change:

AC2 - "If you want to really push change in the right direction, support the industries that have the potential to become part of the solution," Romps said.”

Article AC1 (Iyengar, 2019) has individual responsibility secondary frame in article AC1 as it mentions and puts emphasis on the power of activists and global awareness. Examples of the frame are shown in the quotes below:

AC1 - “Airlines are under increasing pressure to take urgent action as rising global awareness about the climate crisis poses ever greater risks to their business. Greta Thunberg, the teenage climate activist, helped popularize a social media hashtag in her native Sweden that translates to "flight shame."

AC1 - “Environmental activists argue that global aviation emissions are rising fast”

The individual responsibility is only an additional frame in AC1 to help explain the situation. It does highlight the power of individual knowledge and pressure, which is not seen in the other articles. As this thesis is focusing on individualism and nationalism, it has to be noted that individual responsibility frame connects to individualism, as it highlights the power of individuals. This indicates that individualism is hard to find in the ICT articles. In some of the aviation articles, there is a focus on the actions of the activists and the social pressure that these people have, as seen in the previous examples. However, this does not show in the ICT articles, which is understandable as activists do not pay much attention to this sector yet. Greenpeace is the only big NGO showing interest in the ICT sector, and this is also visible in the articles. Greenpeace gets mentioned in article IA3 (Zaug, 2019) as the author of the article gives insight into the topic based on a report released by Greenpeace.

IC3 – “China's data center industry is among the world's largest and last year consumed just over 2% of the country's power, according to a report by Greenpeace and the North China Electric Power University.”

With very little individual action and media coverage on CO2 emissions in the ICT, the topic is therefore missing out on the benefits of highlighting individualism, as it attracts more attention and initiatives deeper thinking about a topic (Rickard et al., 2014).

### 6.2.2 National responsibility frame

Frame	Explanation	Main frame in:	Secondary frame in:
National responsibility	emphasis on the achievements or liability of a country	IC3, IG4	AG3, AG4

The national responsibility frame shows the issue as an achievements or liability of a country and is the main frame in two ICT articles, and the secondary frame in two aviation articles. In IC3 (Zaug, 2019) and IG4 (Sweet, 2019) the main frame is national responsibility, and both the articles are ICT related. For example, IC3 covers the growing data centers in China and solely mentions the data centers as ‘China’s data centers’:

IC3 - “China's data centers produced 99 million metric tons of carbon dioxide last year”

IC3 - “[..]China's data centers will consume two-thirds more energy[..]”

IC3 – “To prevent this, China's data centers need to decouple their electricity consumption [..]”

The article also focuses on the governmental responsibility and compares the country to other countries which is included in the national responsibility frame.

IC3 - “But the Chinese government is aware it needs to act”

IC3 - “In the United States, data centers have significantly reduced their carbon footprint. All of Apple's data centers are powered by clean energy, according to the company, and its new center in China will also use some renewable energy.”

These factors relate to nationalism and while nationalism is found in both aviation and ICT articles, it shows the most in ICT articles. As both the ICT sector and the aviation sector are globally operating, it seems like an unnecessary constraint to have a national frame. Yet, two out of four ICT articles have the nationalism frame as their main frame. This can be explained as the ICT articles talk about data centers, that are placed in a fixed spot within a country and therefore have governmental laws and regulations to oblige to. Meanwhile, aviation crosses physical borders which makes it more difficult to point the responsibility at one country. Another explanation of the nationalism frame in ICT articles is that most articles are originated



from the US. The US is a patriotic country (Huddy & Khatib, 2007), which is why it sees its nation and other nations as separate components, which could it make be more usual to discuss issues from a national perspective.

### 6.2.3 Corporate responsibility frame

Frame	Explanation	Main frame in:	Secondary frame in:
Corporate responsibility	emphasis on the achievements or liability of companies	IC1, IC2, IG4, AC1, AG3	AC2

The corporate responsibility frame is shown to be a frame in six articles, evenly distributed between the aviation and ICT articles. These articles prioritize the responsibility of the companies regarding a specific issue and the analysis found that the articles especially focus on the good that companies are doing. For example, IC1 (Kottasová, 2019) talks about a new implementation Microsoft carried out to tackle the carbon footprint:

IC1 - “Microsoft is making it more expensive for its business units to ignore climate change.”

It identifies the improvements and achievements of the company several times:

IC1- “Microsoft has also upped its climate change targets”

IC1 - “Microsoft said it's on track to cut its carbon emissions by 75% by 2030, but it recognized it "must do more."”

Another example is article AG3 (Early, 2019) that shows that companies take responsibility when it comes to the carbon footprint. While this article talks about the aviation fuel plant, which could be seen as a solution frame, the underlying corporate responsibility frame is actually the main frame. With the title and first paragraph connected to Shell’s participation:

AG3 Title – “Shell to support Europe's first sustainable aviation fuel plant”

AG3 First paragraph – “Shell's aviation fuel arm is to support Europe's first dedicated sustainable aviation fuel production plant in the Netherlands, the oil giant announced Nov. 14.”

Furthermore, the rest of the article was told from Shell’s perspective. As shown in this example:

AG3 – “Shell is to provide technical and commercial expertise to the plant, which is expected to become operational in 2022”

In these three responsibility frames, governments and individuals are occasionally seen as the change-makers, but corporate responsibility takes the lead. Companies are seen as the ones that take and have to take action against the carbon footprint and while they are being held accountable for this, a positive perspective shines through the articles. The articles tell the story of corporate responsibility in a way that makes the companies look good. For example, article AG3 praises and talks about Shells' contribution to a new fuel plant for aviation, as just mentioned. Meanwhile, Shell is the biggest CO2 emitter in the Netherlands and tries to deny its responsibility actively (Milieudedefensie, n.d.). While these statements from the company seem to show Corporate Social Responsibility, "a concept whereby companies integrate social and environmental concerns in their business operations and in their interaction with their stakeholders on a voluntary basis" (Commission of the European Communities, 2001 p.6), the article is actually promoting greenwashing, which is "[...] a practice followed by organizations in which unsubstantiated or misleading claims are made of the environmental and social attributes of a product, service or the company as a brand" (Aggarwal & Kadyan, 2011, p61).

### 6.3 Solution-oriented frames

The solution-orientated frames are an over-coupling group that cover the frames: tech-positive and renewable innovation frames. The articles with these frames give a positive, solution-based view, but mostly have this frame as secondary frame.

#### 6.3.1 Tech-positive frame

Frame	Explanation	Main frame in:	Secondary frame in:
Tech-positive	emphasis on the resolutions shaped by technology	NA	IC1, AC1, AC2, AG3, AG4

The tech-positive frame covers the mentioning of technological innovation as the solution for the suggested problem. As mentioned in the introduction of this research, technological optimism is integrating in today's society, and this really showed during the analysis. Technological innovation is seen as one of the biggest solutions of the carbon footprint and tech-positivity is a returning secondary frame in most articles. The frame was a secondary frame in almost all the articles and therefore an underlying positive view on technology was always present. The frame is not noticeable at first glance, but statements are made that technology is a solution, without putting too much significance to it. These statements can be seen as prove that the articles already assume that the technology is the solution against carbon

emissions, without any further explanation needed. Some examples from AG3 (Early, 2019), AC1 (Iyengar, 2019) and IC1 (Kottasová, 2019) show these assumptions.

AG3 – “They said the industry plans on using a combination of sustainable aviation fuels, efficiency measures and new technologies [..]”

AC1 - “EasyJet CEO Johan Lundgren said in a statement. "Our priority is to continue to work on reducing our carbon footprint [..] to support the development of new technology [..]"

IC1 - “Microsoft said it would develop AI products and services that would help other businesses reduce their carbon footprint”

AI products stand for ‘Artificial Intelligence’ and is a new digital technology that is a significant CO2 emitter. Although it can definitely be used to reduce emissions, it cannot be left unrecognized that the products have a carbon footprint themselves (Dhar, 2020).

The tech-positive frame shows an interesting view on sustainable development. Even though the frame was mostly identified in the aviation articles, it was also visible in an ICT article. This would mean that the problem of (Information Communication) Technology can be solved by technology. For example, article IA1 stresses the carbon contribution of digital technologies:

IC1 – “The share of global greenhouse gas emissions that can be attributed to digital technologies has been growing too”

IC1 – “The fee is charged based on energy use from data centers [..]”

However, the article also suggests technology as the solution:

IC1 – “Microsoft said it would develop AI products and services that would help other businesses reduce their carbon footprint“

As technology is such an important part of sustainable development, it must be difficult to criticize the ICT sector that is based around technology. Hence, the ICT sector is generally seen as a helping hand in reducing the global carbon footprint and does not leave much space for a negative perspective.

### 6.3.2 Renewable innovation

Frame	Explanation	Main frame in:	Secondary frame in:
Renewable innovation	emphasis on the possibilities of renewable energy	IG4, AG4	IC1, IC2, IC3, AC1, AC2, AG3

Next to the tech-positive frame, the renewable innovation frame is also present in most articles, but contrary, this frame is mostly seen in the ICT articles. The renewable energy seems to be the solution for reducing CO2 emissions and this is emphasized in the articles. The aviation articles give a lot of hope to electric energy for new planes, for example in AG4 (Whitehead, J., & Kane, M. 2019):

AG4 – “Electric aircraft technology is rapidly developing locally and overseas, with the aim of potentially reducing emissions and operating costs by over 75 percent”

AG4 – “It’s time to start accounting for electric aviation if we are to capitalize on its potential economic and environmental benefits.”

AG4- “While benefiting smaller airports, electric aircraft also could improve the efficiency of some larger constrained airports.”

Meanwhile, renewable innovation is mainly seen as a solution for decreasing CO2 emissions in the ICT sector by using renewable energy for data centers, for example in IC3 where they talk about using renewable energy for the data centers in China:

IC3 – “If renewable energy increased to 30% by 2023, 16 million metric tons of CO2 emissions could be avoided, according to Greenpeace.”

The difference between the framing of technological innovation in the two sectors is that the aviation articles talk about new products, while the ICT sector talks about reducing the carbon footprint of the current material. While this sounds good at first, reusing and recycling material, it could also be a problem. Renewable energy for data centers was shown to be the solution for the CO2 emissions of the ICT sector, meanwhile it is already proven that even though renewable energy indeed reduces the emissions of the sector, it is not enough and there is a need for an actual reduction in energy use (Freitag et al., 2020). Putting renewable energy on such a pedestal takes attention away from other solutions. Solutions that can help make a bigger change.

## **8. CONCLUSION**

The aim of this research was to contribute knowledge in the research field of Environmental Communication, with a qualitative framing analysis on media coverage of ICT carbon emissions and aviation carbon emissions. The framing analysis helped answering the three earlier identified research questions. **RQ 1** What news frames can be identified and how do they differ within media coverage on ICT emissions compared to aviation emissions? Firstly,

in the content review done before the framing analysis where 1172 online articles were screened for relevancy on ICT or aviation emissions, only four relevant articles were about the emissions of the ICT sector, in comparison to 73 articles about the emissions of the aviation industry. This shows a huge gap in the amount of media coverage on ICT and the coverage on aviation. Furthermore, the analysis showed that the attention of the ICT articles went to data centers. Even though data centers are a big part of the digital carbon footprint, it does not recognize the other polluting aspects of the ICT sector, like user devices and networks (Ericsson, 2020). The problem with CO<sub>2</sub> emissions and especially in the ICT sector is the invisibility. People might not connect browsing on the internet with emitting CO<sub>2</sub> and it is hard to understand how these types of actions are contributing to the carbon footprint. This is a common problem within climate change communication (Sheppard, 2012). The data centers are something that is the most 'visible' within the ICT sector and on that account the easiest to cover in the mass media. In contrast, the aviation articles gave a bigger variety of subjects. Electric planes, social action, carbon offsetting, and renewable fuels were all given attention. Furthermore, the research identified five frames, corporate responsibility frame, individual responsibility frame, national responsibility frame, tech-positive frame and renewable innovation frame. These frames show that the media coverage of both the aviation and ICT sector gives a techno-centrism view, where the big companies are the 'heroes'. Moreover, individual responsibility is lacking in the ICT articles, but the national responsibility frame is more prominent in the articles about the ICT sector than the aviation sector. Additionally, corporate responsibility is a prominent frame in both the ICT and the aviation articles. These factors will be examined by answering the two other research questions. **RQ 2** How can nationalism and individualism be identified in the news? The analysis discovered three frames connected to nationalism and individualism, grouped in the responsibility frames. Nationalism is more prominent in the ICT articles, identified as the national responsibility frame. While the ICT sector crosses border and is an international sector, it showed nationalistic features in the media coverage. In chapter 3, research by Berglez et al., (2009) mentions that nationalism has border limitations, even though climate change is in need of global journalism. This is also a problem with the ICT articles as the ICT sector will need a global solution for the carbon footprint and purely focusing it onto countries can disturb the progress of finding a solution. In contrary, individualism was more prominent in the aviation articles, identified as the individual responsibility frame. Berglez mentioned that individuals cannot stop climate change alone and therefore individualism is not always the right answer. While this applies to a certain extent on this topic, aviation is something that individuals could have an impact on. As mentioned in

some of the articles, social pressure made aviation companies take action. Individual responsibility makes the reader more engaged in the stories, which is lacking in the ICT articles. In this analysis, another frame was distinguished within the responsibility frames. The corporate responsibility frame was an undeniable frame in most articles. While it can officially be seen as individualism, as it targets individual companies, it was given its own frame as it did not give responsibility to the reader, but to a bigger party.

**RQ 3:** How is the positive and negative perspective used to argue for the carbon impact of the two topics? Techno centrism plays a big role in today's society, and this really showed in this research. The benefits and positive outlook on technology are highlighted in the ICT sector as well as the aviation sector. Technology is shown as the solution and criticism of these solutions are neglected. This positive perspective on technology and companies seems to give a one-sided view on the ICT sector as it shows a lot of positive news about the ICT sector with e.g. new technology innovation, it neglects the underlying problems of the CO<sub>2</sub> emissions. Furthermore, the analyzed articles had an overall positive perspective on the CO<sub>2</sub> emissions. It focused on the solutions and actions taken by companies. Where those companies were even portrayed as 'heroes'. These types of articles can even be identified as positive journalism, explained in chapter 4. This could be dangerous as it can show a one-sided view of reality and takes away focus of the negative, but important, aspects. While this positive journalism is seen in the aviation articles, it is mostly dangerous for the ICT sector. Especially because the aviation articles even promote (IC)Technology as a solution to the carbon problem. As technology is such an important part of reducing the emissions, it must be difficult to criticize the ICT sector that is based around technology.

The ICT sector is unavoidable in western society, even this study was powered by the ICT sector. While reading and talking about the environmental impact of the ICT, this paper was written on a laptop and the research was done with the information on the internet. It is almost like talking about the negative impacts of flying, to the person next to you on the plane. However, that's where the difference between the ICT sector and the aviation sector comes into play. Even though the carbon footprint of the ICT sector is equivalent to the aviation sector, the individual impact is different. Only 10 percent of the global population flies annually, and around 70 percent of the global population uses ICT annually (Ericsson, 2020). This reveals that the individual use of ICT has a much smaller carbon footprint than the individual use of aviation. It also explains why there is less individual responsibility in the media coverage of the ICT sector than the aviation sector. The topic of CO<sub>2</sub> emissions in the ICT is therefore

missing out on the benefits of highlighting individual responsibility, as it attracts more attention and initiatives deeper thinking about a topic (Rickard et al., 2014).

This study hopes to add recognition on the environmental impact of the ICT sector, in the field of communication and media, where this issue is lacking attention. The ICT sector is growing, and the world is getting dependent on the internet and other digital innovations, therefore it is important that the sector takes responsibility for its carbon footprint. As seen in the analysis, the research field of communication and media is not the only place where knowledge about the carbon footprint of the ICT sector is missing. Also, the media itself is lacking coverage on ICT emissions. The mass media can help change the publics' attention to certain topics and influence their behavior, as explained in chapter 4, which makes it essential that the media does not only show the ICT sector in a positive light. As this research was done on a small number of articles and only focused on English-based 'traditional' news coverage, more research is needed. As social media is expanding and not included in this research, a focus on social media coverage of CO<sub>2</sub> emissions of the ICT sector would be valuable. Moreover, a focus on local news would be an addition to the research field. Above all, this research paper, hopefully, urges more future research in the field of communication and media on the topic of the environmental impact of the ICT sector.

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